

| <p>Petrol</p> | <p>Diesel</p> | <p>CNG</p> | <p>CombiFuel®</p> | <p>Fullhybrid</p> | <p>Plug-in-Hybrid</p> | <p>Electric</p> | <p>Hydrogen propulsion</p> |
|--|---|--|--|--|--|---|--|
| <p>The combustion of the petrol engine «Otto engine» is based on a compressed air-petrol mixture which is brought to combustion in the cylinder chamber. When the mixture is compressed, pressure (8-18 bar) and heat (400-600°C) are generated. The resulting exhaust gases are cleaned by a 3-way catalytic converter in modern vehicles and the particles are cleaned by a particle filter.</p> | <p>The diesel engine works with a self-ignition of the injected fuel in the compressed combustion air.</p> | <p>Gas engines are divided into CNG (Compressed Natural Gas) and LPG (Liquefied Petroleum Gas). Gas engines are a subgroup of the classic combustion engines.</p> | <p>CombiFuel® is an innovative and green liquefied gas injection-System. CombiFuel® is a newly developed powertrain system that runs on LPG, with the potential to leave a unique ecological and economic footprint. The plug-in technology has been designed to be universally applicable to most combustion engines. CombiFuel® can be applied universally for all gasoline engines as well as for all diesel engines. Universally applicable, from the smallest vehicle to a truck (40Tons). Thanks to an emission reduction of up to 95 % and a reduction in fuel costs of up to 50 %, CombiFuel® will be the ideal investment for future for fleets and commercial vehicles (trucks).</p> | <p>Hybrid cars have both an internal combustion engine and a fuel tank as well as an electric motor and a battery. A control system regulates when which drive is used.</p> | <p>Plug-in hybrids are based on the same system as full hybrids. However, they have a larger battery, which allows more range, but must be charged externally.</p> | <p>The lithium-based batteries, which are environmentally unfriendly to produce, emit electrical energy that drives the electric motor. The mechanical kinetic energy converted by the electric motor drives the wheels.</p> | <p>To generate energy from hydrogen and oxygen stored in gaseous form, the hydrogen engine contains a fuel cell that drives an electric motor.</p> |
| Advantages | | | | Advantages | | | |
| <ul style="list-style-type: none"> The lower pressure and temperatures enable cheaper engine production, which has a positive effect on the acquisition costs Sporty driving feel as well as smoother running The emission values of nitrogen oxide are below those of diesel engines | <ul style="list-style-type: none"> Lower consumption per 100 km compared to petrol engines. Maximum torque available at low engine speeds. Acceptable consumption even in city traffic More pleasant behaviour and smoother pace than petrol. Less CO₂ is emitted into the atmosphere | <ul style="list-style-type: none"> Fewer pollutants than petrol and diesel engines Better CO₂ balance compared with petrol/diesel Cleaner combustion | <ul style="list-style-type: none"> Emission reduction of up to 95 % & almost 100% less particles and NO_x significant reduction of CO₂ reduction of fuel costs up to 50% A condensing module recognises the liquid gas mixing ratio e.g. (propane / butane) The CFS control unit works adaptively and is OBD-capable. Innovative plug & play system Approx. 1.3 billion existing vehicles (petrol/diesel) Many more... | <ul style="list-style-type: none"> Reduction of pollutant and noise emissions. The recovery of braking energy charges the batteries of the electric motor Simultaneous use of both forms of energy enables powerful acceleration No concerns about range | <ul style="list-style-type: none"> Reduction of pollutant and noise emissions No concerns about range No driving bans in cities because of the switch to E-Drive | <ul style="list-style-type: none"> Maximum torque is already reached at the start No pollutant and noise emissions during operation High driving comfort No driving bans in cities | <ul style="list-style-type: none"> No local pollutant emissions Short refuelling time Compared to electric cars, the range is higher with less weight No driving bans in cities |
| Disadvantages | | | | Disadvantages | | | |
| <ul style="list-style-type: none"> Consumption is significantly higher with petrol than with diesel engines CO₂ emissions are higher than with diesel engines Direct-injected petrol engines have higher particle emissions Low power delivery in the lower speed range | <ul style="list-style-type: none"> Higher nitrogen oxide and particle emissions than with petrol engines. Complex exhaust gas purification (AdBlue) Turbocharging (turbo, compressor) mandatory | <ul style="list-style-type: none"> Low range in gas-only mode. Needs a conventional fuel as a reserve/ supplement Gas is carried in pressurised tanks of up to 300 bar in the vehicle | <ul style="list-style-type: none"> Purchase price Fill up the tank with two different fuels | <ul style="list-style-type: none"> Purchase price and weight somewhat higher than for combustion engines | <ul style="list-style-type: none"> The acquisition costs are significantly higher than those of combustion engines. Fuel savings are hardly feasible on long journeys Regular charging of the battery is necessary The vehicle is heavier and more prone to problems due to two systems Maintenance costs for plug-in hybrids are higher than for conventional combustion engines | <ul style="list-style-type: none"> High acquisition cost Less range than a combustion vehicle Longer charging times Battery production requires elements such as cobalt and manganese, some of which are mined under questionable conditions According to studies (see link below), the production of a battery alone generates 61-106 kg of CO₂ per kWh. A luxury electric vehicle compared to a diesel car will only become CO₂-neutral after approximately 70,000 kilometres or after about 5 years Higher fine dust formation during production & driving (for heavy vehicles with long range) | <ul style="list-style-type: none"> Only two models available Few filling stations High acquisition costs Liquefied and compressed hydrogen (700 bar, -250°C) is flammable even at low temperatures. That's why high-pressure hydrogen tanks are usually made of several layers of plastic, reinforced with carbon fibres |
| Prospects | | | | Prospects | | | |
| <p>Despite 150 years of development, there is still potential for optimisation.</p> | <p>Despite negative perceptions among the population and politicians, the compression-ignition engine is not a model that will be discontinued soon.</p> | <p>Until now, gas cars have never been able to establish themselves due to various myths.</p> | <p>CombiFuel is a bridging technology (e.g. Europe 5 years, developing countries up to 30 years) that offers users of petrol and diesel vehicles the opportunity to make their vehicle more environmentally friendly. This also circumvents future driving bans.</p> | <p>Hybrid engines embody an environmentally friendly bridging technology until even more efficient technologies become established on the market.</p> | <p>Plug-in hybrids are also a bridging technology suitable for short-distance drivers.</p> | <p>Europe's manufacturers have invested billions in e-vehicles and politicians are also pro e-mobility. The expansion of the public charging infrastructure is inevitable. In certain European areas, the charging infrastructure is operated by high-emission diesel generators and/ or during power outages. Moreover, the structure is sparse in some areas.</p> <p>Source: www.combifuel.ch/en/powertrains</p> | <p>The hydrogen vehicle is still a niche product and models and refuelling options are rare. But that is about to change. The H₂ promotion association wants to create a nationwide network. In addition, numerous manufacturers have plans for hydrogen vehicles up their sleeves. Nevertheless, in the medium term, hydrogen will mainly be found in the commercial vehicle sector.</p> |